

**lococube**<sup>®</sup> GT-950  
**Art. No. 0895-0950**

**MANUAL**



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## SAFETY INSTRUCTIONS

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and the connected equipment. These notices are highlighted in the manual by a warning symbol and are marked as follows according to the level of danger:



**Only qualified personnel should be allowed to install and work on this equipment. Qualified persons are defined as persons who are authorized to commission, to ground and to tag circuits, equipment and systems in accordance with established safety practices and standards.**



**Turn off the power supply before performing any wiring operations! Short circuits can be harmful, critical and can cause explosions and serious burns!**



**Please read this manual carefully and observe all safety instructions!**

## DESTINATED USE

The lococube<sup>®</sup> is designed for universal measuring, controlling and regulating applications.

## DISCLAIMER

BARTH<sup>®</sup> assumes no liability for usage and functionality of the lococube<sup>®</sup> in case of disregarding this manual. The strict accordance of this manual is important since the installation methods, peripheral connections, usage and maintenance can not be controlled by BARTH<sup>®</sup>. Therefore BARTH<sup>®</sup> assumes no liability for any claim.

## 1 Product description

### 1.1 Features

- Highly flexible mini-PLC for OEM solutions
- High-Performance 32 Bit ARM<sup>®</sup> Cortex<sup>®</sup> M4
- RS485
- CAN 2.0A/B, CAN FD
- RS232
- Comprehensive Fail Safe Functions
- Open Source 'C' Programming
- Wide Operating Voltage Range 7 to 32 VDC
- Wide Operating Temp. Range -40 to +70°C
- Vibration resistant and rugged due to potting
- CE conformity
- Engineered and manufactured in Germany

### 1.2 Applications

- Industrial and process control
- Test and control systems
- Automotive and maritime technology
- Technical education
- White goods

### 1.3 Delivery content

- 1x lococube<sup>®</sup> GT-950
- 1x Connector for supply and CAN
- 1x Connector for Communication interface

## 2 Installation

### 2.1 Mounting

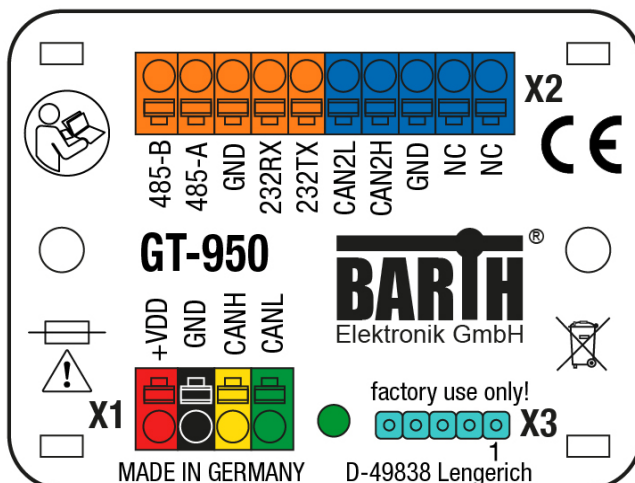


The lococube® must be installed and wired by a trained technician who knows and complies with both the universally applicable engineering rules and the regulations and standards that apply in specific cases.

Fastening the GT-950 follows using either the integrated mounting holes for screws or the holes for cable ties. The cable tie installation method is recommended for fastening the lococube® on wiring harness, tubes or other mechanical parts.

### 2.2 Wiring

#### 2.2.1 Overview



#### X1 connector: Power supply and CAN pins

|   |      |                          |
|---|------|--------------------------|
| 1 | VDD  | positive supply terminal |
| 2 | GND  | ground terminal          |
| 3 | CANH | CAN high terminal        |
| 4 | CANL | CAN low terminal         |

#### X2 connector: Interface connector

|    |       |                      |
|----|-------|----------------------|
| 1  | NC    | Not used             |
| 2  | NC    | Not used             |
| 3  | GND   | Ground               |
| 4  | CAN2H | CAN Bus 2 / high     |
| 5  | CAN2L | CAN Bus 2 / low      |
| 6  | 232TX | serial port transmit |
| 7  | 232RX | serial port receive  |
| 8  | GND   | Ground               |
| 9  | 485-A | serial port A        |
| 10 | 485-B | serial port B        |

#### 2.2.2 Connecting the power supply

The GT-950 features an outstandingly wide supply voltage range from 7 to 32 VDC at lowest current consumption. So the lococube® can be integrated within battery supplied 12V or 24V DC systems (cars, trucks, battery powered cars, forklifts and diggers, for example).



**Turn off the power supply before performing any wiring operations!**



**False electrical connection, voltage reversal or disregarding the electrical specifications may cause irreversible damage of the lococube®!**

Connect the supply voltage of 7 to 32 VDC to the 4-pole terminal X1 of the lococube®. Wire the positive supply to the 'VDD' marked connection. The negative (ground) will be wired to the 'GND' connection. All terminals are carried out as pluggable spring terminal connectors for a wire gauge of 0.25 to 1.5mm<sup>2</sup>.



**Ensure correct power supply voltage range and polarisation! External fusing of 6A max. is mandatory! Disregarding may cause irreversible damage of the lococube®!**

#### 2.2.3 Connecting the CAN interface

The X1 connector of the lococube® contains the CAN-specific pins 'CANH' and 'CANL'.



**The voltage at CANH or CANL must not exceed -55 or +55 VDC referred to ground (GND). Higher voltages may cause irreversible damage of the lococube®!**

There is no termination resistor (120R) integrated in the lococube®. Please add a 120R resistor at both ends (2) for CAN bus termination.

## 3 Programming

### 3.1 Programming options

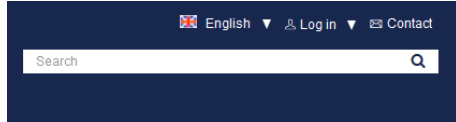
The lococube® GT-950 supports several programming options. The table below shows all supported programming environments:

| Programming | Software       | Manual      |
|-------------|----------------|-------------|
| C           | STM32 Cube IDE | coming soon |
|             | KEIL® µVision  | 9022-0020   |



We kindly refer you to the following manufacturer website:

[www.barth-elektronik.com](http://www.barth-elektronik.com)



Type in the product name (e.g. GT-950) and get the product-related documents and software.

## 3.2 Programming interface

To program the GT-950, please use the VK-35 connection cable (BARTH® item no. 0091-0035). Programming and debugging takes place via the X3 connector.

## 4 Appendix

### 4.1 Specifications

#### 4.1.1 General

|                            |  |
|----------------------------|--|
| <b>Hardware design</b>     | BARTH® lococube® gateway-fully enclosed in proprietary PU resin, tiny and rugged housing with plugable spring terminal connectors, ultra-lightweight |
| <b>Programming options</b> | Open Source ,C' Programming  |
| <b>Interfaces</b>          | CAN 2.0A/B/open®/SAE J1939 NMEA2000, CAN FD / 1-Wire®  |

#### 4.1.2 Power supply

|  |   |
|--|---|
| <b>Operating voltage</b>                   | 7 to 32 VDC   |
| <b>Current consumption</b>                 | nominal 10 mA at 55 VDC (depending on configuration)          |
| <b>Fusing</b>                              | 5 A max. (external) mandatory for voltage reversal protection |
| <b>Voltage reversal protection</b>         | yes (combined with external fuse)                             |
| <b>ESD/TVS protection</b>                  | yes, integrated   |
| <b>Heat dissipation air (at full load)</b> | normally < 2 W  |

### 4.1.3 Interfaces

|                 |  |
|-----------------|--|
| <b>232RX/TX</b> | Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards<br>VCC Supply<br>Operates up to 250 kbit/s   |
| <b>RS485</b>    | Allow up to 64 transceivers on the bus<br>up to 12 Mbps  |
| <b>CAN</b>      | CAN 2.0A/B:<br>11/29 bit ID, base frame format<br>Baud rates:<br>50, 100, 125, 250, 500 kbit, 1Mbit<br>CAN FD<br>Baud rates: 2, 5, 8Mbit<br>CANopen® multi line, single line, master, slave<br>SAE J1939<br>NMEA 2000<br>Meets or exceeds the requirements of applications ISO 11898-2, loss of ground protection from -55 V to +55 V, thermal shutdown protection |

#### 4.1.4 Security features

|                          |   |
|--------------------------|---|
| <b>Security Features</b> | System and independent watchdog<br>Fail safe oscillator<br>Power on/down reset<br>Supply voltage supervisor |
|--------------------------|---|

#### 4.1.5 Program and data memory

|               |   |
|---------------|---|
| <b>Memory</b> | Flash program memory 1: 4 Mbit<br>Flash program memory 2: 1 Gbit<br>Flash program memory 3 (intern): 4 Mbit |
|---------------|---|

#### 4.1.6 Timebase (oscillator)

|                            |  |
|----------------------------|--|
| <b>Primary Oscillator</b>  | Crystal quartz MEMS unit (precise ,micro-electro-mechanical system') |
| <b>Nominal Frequency</b>   | 16 MHz   |
| <b>Frequency tolerance</b> | $\pm 50 \times 10^{-6}$  |
| <b>Frequency aging</b>     | $\pm 5 \times 10^{-6}$ / year max.                                   |

#### 4.1.7 Electrical connection

|                              |   |
|------------------------------|---|
| <b>Electrical Connection</b> | pluggable spring terminal connectors 0.25 to 1.5 mm <sup>2</sup><br>Manufacturer: Phoenix Contact<br>Series: COMBICON<br>Type: FMC1,5/x-ST-3,5-BK |
|------------------------------|---|

#### 4.1.8 Electromagnetic compatibility (EMC)

|  |  |
|--|--|
| <b>Electrostatic discharge (ESD) on IN1 to IN5</b> | 20 kV air discharge<br>30 kV contact discharge<br>(IEC/EN 61 000-4-2, level 3) |
| <b>Electromagnetic fields</b>                      | Field strength 10 V/m<br>(IEC/EN 61000-4-3)                                    |
| <b>CAN bus terminals (CANH, CANL to GND)</b>       | IEC 61000-4-2:<br>Unpowered Contact Discharge<br>$\pm 15000$ V                 |
|  | IEC 61000-4-2:<br>Powered Contact Discharge<br>$\pm 8000$ V                    |

#### 4.1.9 Environmental conditions

|                                    |  |
|------------------------------------|--|
| <b>Operation temperature</b>       | -40 to +70 °C<br>(IEC 60068-2-1/2)                       |
| <b>Storage temperature</b>         | -40 to +70 °C<br>(IEC 60068-2-1/2)                       |
| <b>Relative humidity</b>           | 5 to 95% non-condensing<br>(IEC 60068-2-30)              |
| <b>Air pressure (in operation)</b> | 500 to 1500 hPa  |
| <b>Shock resistance</b>            | min. 300 m/s <sup>2</sup><br>(IEC 60068-2-27)            |
| <b>Vibration resistance</b>        | min. 80 m/s <sup>2</sup> @ 10..100 Hz<br>(IEC 60068-2-6) |
| <b>Degree of protection</b>        | IP 20 (not evaluated by UL)<br>(EN 50178, IEC 60529)     |
| <b>Drop</b>                        | Drop height: 1000 mm<br>(IEC 60068-2-31)                 |
| <b>Free fall (packaged)</b>        | 1500 mm (IEC 60068-2-32)                                 |



#### 4.1.10 Weight and dimensions

|                   |  |
|-------------------|--|
| <b>Weight</b>     | 85 g (without connectors)                        |
| <b>Dimensions</b> | 60 x 45 x 21 mm (LxWxH)<br>Height housing: 11 mm |
| <b>Mounting</b>   | via two M4 screws or 3.6mm cable ties            |

#### 4.1.11 MTTF and MTTFd

|                                 |  |
|---------------------------------|--|
| <b>Calculation basis</b>        | DIN EN ISO 13849-1:2008 (@T=25°C)  |
| <b>Calculation formula</b>      | DIN EN ISO 13849-1:2008 Annex C.5: MTTF, MTTFd data of electrical components (typical and worst case)<br>D.1: Parts count method (worst case with safety factor 10)<br>$MTTF = \frac{1}{\sum_1^n \frac{1}{MTTF_n}}$<br>$MTTFd = MTTF \cdot 2$<br>$MTTFd = \frac{MTTF \cdot 2}{10}$<br>(worst case) |
| <b>MTTF [years]</b>             | 195  |
| <b>MTTFd [years]</b>            | 390  |
| <b>MTTFd worst case [years]</b> | 39   |
| <b>Explanation</b>              | This information is given without any guarantee. The indicated product is no safety component according to the machine directive 2006/42/EC (subject to modifications).  |

#### 4.1.12 Certifications & Approvals

|  |  |
|--|--|
|   | 2004/108/EG<br>2004/108/EC<br>2014/30/EU |
|  | CANopen®<br>Vendor ID: 46Ah              |


#### 4.1.13 Ordering information

|                                       |   |
|---------------------------------------|---|
| <b>Ordering information mini-PLC</b>  | gateway GT-950<br>Art. No. 0895-0950<br>GTIN 4251329406042  |
| <b>Ordering information accessory</b> | Programmer ST-Link/V2 ISOL<br>(Open Source programming)<br>Art. No. 0017-0066<br>GTIN 4251329401269 |
|                                       | Programmer PG-30<br>(Open Source programming)<br>Art. No. 0017-0030<br>GTIN 4251329401481           |

#### 4.2 Documents, videos and software



Detailed information, additional documents, application notes and videos relating to this product are downloadable from [www.barth-elektronik.de](http://www.barth-elektronik.de).

#### 4.3 Disposal

|   |   |
|---|---|
|  | <p><b>If you wish to finally dispose of the product, ask your local recycling centre or dealer for details about how to do this in accordance with the applicable disposal regulations.</b></p> |
|---|---|

#### 4.4 Conformity declaration

For the following designated product it is hereby confirmed, that the construction in that technical design brought by us in traffic corresponds to the standards specified below. In the event of any alternation which has not been approved by us being made to any device as designated below, this statement shall thereby be made invalid.

|  |  |
|--|--|
| <b>Description</b>   | lococube® mini-PLC   |
| <b>Type</b>  | GT-950   |
| <b>Art. No.</b>  | 0895-0950  |
| <b>Directive 2004/108/EG relating to electromagnetic compatibility (EMC)</b>       | Applied norms:<br>2004/108/EG<br>2004/108/EC<br>2014/30/EU   |
|   |  |
| <b>RoHS Directive 2011/65EU</b>  | We hereby declare that our product is compliant to the RoHS Directive on restriction of the use of certain hazardous substances in electrical and electronic appliances.   |
|  | BARTH Elektronik GmbH declares conformity of the product for which this manual is intended with the UKCA equivalents of the aforementioned CE regulations. We therefore deem the product to be in full compliance with UKCA regulations and take full legal responsibility for it.<br>This declaration was issued on 30.11.2021. |

BARTH® Elektronik GmbH  
Lengerich, 20.12.2021

*D. Barth*

Dipl.-Ing. (FH) D. Barth, CEO